

## ***Interactive comment on “Technology and human purpose: the problem of solids transport on the earth’s surface” by P. K. Haff***

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Page references are to referee’s report.

1st paragraph of referee letter: “Although the current structure is fine, there nonetheless might be value in organizing the sections into appropriately titled super-headings. . . .”

Response: Sectional organization has been modified.

Page 419 Line 12: ...spatially distributed to localized high concentration zones widely dispersed...?

Response: Wording clarified along lines suggested.

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Line 26: Should we include human/animal transport (consistent with page 422)?

Response: Yes, done.

Page 420 Line 5: On first read, this looks like the ratio of advective to diffusive rather than the diffusive to advective. Might I suggest wording like: “...if on dimensional grounds we define a diffusivity as the product  $v_l$  such that the diffusive timescale is  $L/v_l$ , then the ratio of diffusive to advective time<sup>2</sup> scales....”

Response: Wording has been modified to clarify meaning.

Page 521 Line 5: localized sources?

Response: I meant sources that are randomly located. Wording changed to avoid confusion.

Page 423 Line 6: The point is well taken, but does high-friction terrain include surfaces navigable and un-navigable by wheels? Do we include “smooth” roads/rails within “high friction”? (Elaboration, methinks, arrives in the next section. Perhaps a transition sentence/phrase would be useful here.) The analogy between terrestrial skin and form resistance with the fluid counterparts is compelling.

Response: A transition sentence has been added.

Line 24: relative size of surface irregularities in contact with the advective flow (that is, over the “wetted perimeter”).

Response: Wording changed to reference the idea of wetted perimeter.

Page 424 Line 4: Is this idea necessarily restricted to the steady-state condition? Is it more general to just say something like “in order for transport to persist...”?

Response. Yes, that is correct. Suggested wording change accepted.

Line 14: The gradient involves distance, so might there be value in exploring/elaborating the idea that, once humans/purpose are involved, a “strong” gradient

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over short distances yields transport, even if inefficient, at least over short distance (i.e. communities nearby a source benefit more than those far away – until development of efficient advective systems)? In turn, therefore, is there something like an “effective” gradient formed as the ratio of concentration to the distance-friction (i.e. required work) product?

Response: I have added a short paragraph that expresses this idea, but a full development of this interesting point lies beyond what I think is reasonable to include in the present paper.

Page 425 Line 27: I recommend rewording to something like: “The dynamical problem that “purpose” solves is this: It enables action-at-a-distance dynamics in the absence of a continuous potential gradient between separated source and sink zones capable of inducing transport. Purpose in effect provides a basis for...”

Response: Done.

Page 426 Line 13: I’m interpreting this sentence to mean that attributing ultimate causation to purpose skirts the issue..., whereas my reading of the material leading up to this sentence suggested that we might be avoiding attributing causation to purpose, in which case it seems that the lack of attributing causation to purpose skirts the issue... (which, methinks, is consistent with the next paragraph). Am I misinterpreting? Perhaps reword slightly to something like... “appealing to human purpose risks giving the impression of skirting the issue/challenge of providing valid...”

Response: The relevant part of the paragraph has been reworded along lines suggested by referee.

Line 16: This is one of the most important paragraphs of the paper.

Page 427 Line 24: “information content” is not clear to me. Does this refer to “structure” or “configuration” or “function”? (I see that this is fully explained starting with the first sentence on the next page.) Also perhaps, “during the transport process” or “while

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being transported”

Response: Text clarified along lines suggested by referee.

Page 428 Line 1: “...in transport dynamics, as do fluids.”

Response: Text has been reworded.

Page 429 Line 15: Perhaps “...use of energy that leads to no added value of purpose...”

Response: Text has been reworded.

Page 430 Line 4: It is unclear what “such a transport mode” is referring to. Does this mean transport in response to the “potential gradient”?

Response: Re-expressed as “purposed transport”.

This is a clear summary paragraph. Might there be value in adding a brief (perhaps parenthetical) example or elaborating phrase regarding “new dynamical principles”?

Response: Yes, this has been done, with reference to entropy production and to meme dynamics.

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Interactive comment on Earth Syst. Dynam. Discuss., 3, 417, 2012.

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